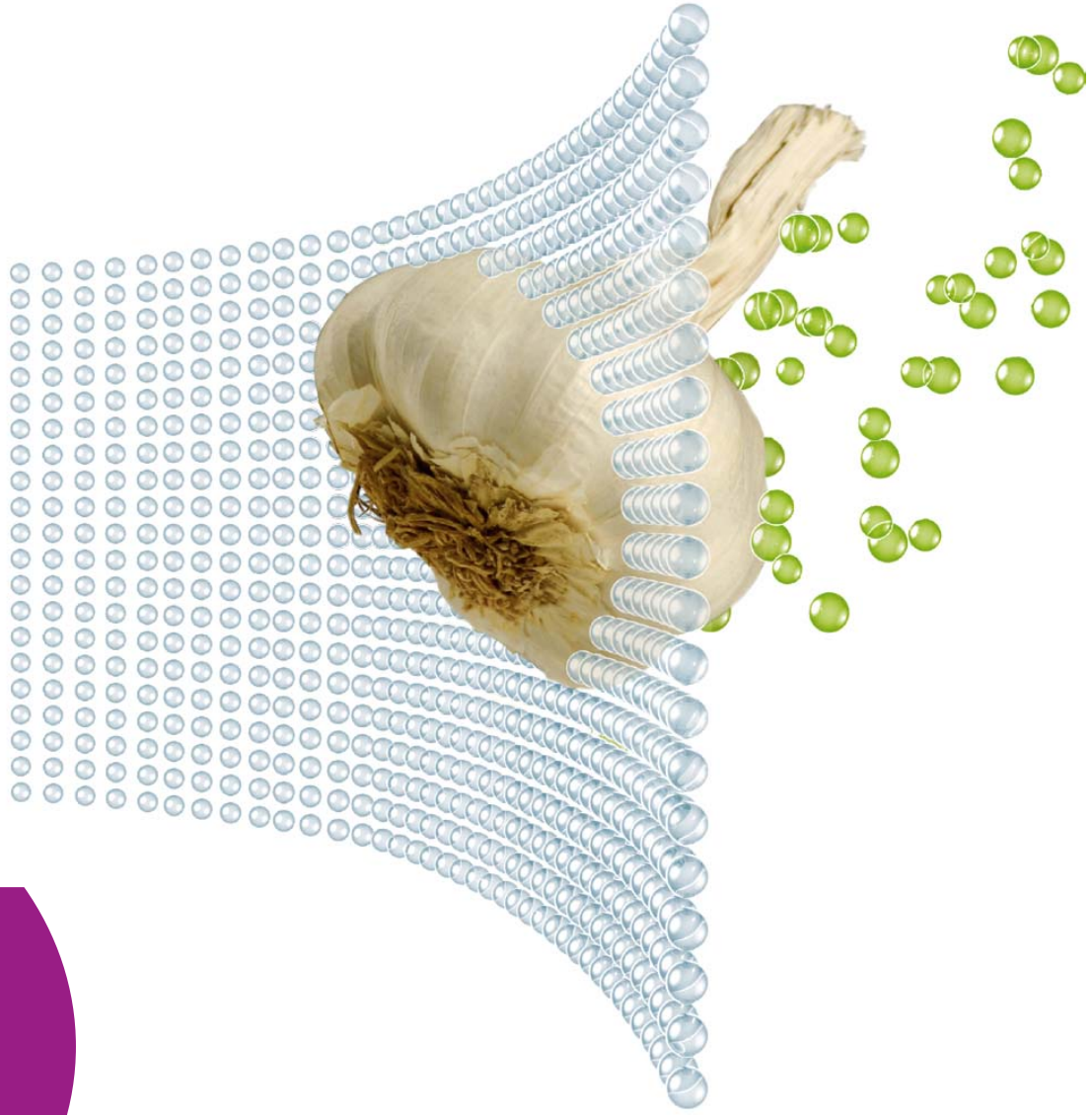

CO_2 1st choice for phytoextraction

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Active ingredients under scope of carbon dioxide

PUFA´S

- Seed oils
- Marine oil (krill, mussel)
- Bran oils
- Algae bio mass

CAROTINOIDS

- Marine raw materials
- Algae bio mass

PHOSPHOLIPIDS

- Marine oils (krill)
- Vegetable oil

STEROLS

- Vegetable oils

New technologies should preserve integrity & stability of active ingredients generally

Polyunsaturated fatty acids (examples)

Important unsaturated fatty acids

n-3 fatty acids: ALA (18:3), EPA (20:5), DHA (22:6)
n-6 fatty acids: LA (18:2), GLA (18:3), AA (20:4)

Nutrition aspects:

n-6 / n-3 ratio recommended: 4–5:1/ 5–10:1

Best source for n-3 (EPA/DHA): marine oils esp. krill oil (30–40%)
Best source for n-6: vegetable oils

Seed oils (example pomegranate)

- Higher yields of oil and lower thermal load compared to cold pressing
- Efficacy >80% (only 40% with cold pressing)
- Low peroxide value

Composition of pomegranate oil: % of total fatty acids

(approximative, depends on variety)

- CNLA (18:3; 9c,11t,13c): ~45% (punicic acid)
- LA (18:2, n-6): ~30%
- OA (18:1, n-9): ~18%

Rice oil (example rice bran)

$scCO_2$ of rice bran (heat stabilized)

Typical results

- Yield: 14–16.6% extract (=75–82% efficacy) depending on rice bran fraction used

Composition of crude RBO (approximative):

- Phytosterols, *total*: ~4.5–5%
  Thereof oryzanol: ~ 50%

- % of total fatty acids** (main components)
  LA (18:2, n-6)
  OA (18:1, n-9)
  } 80%

**similar to sesame/soja

Marine oils
(example green shell mussel)

$scCO_2$- process of freeze dried mussel powder

Typical results

- Yield: 4.0–5.5%
  (depending on raw material and sc-process settings)

Composition of crude mussel oil (approximative):
(expressed as % of total fatty acids, main components)

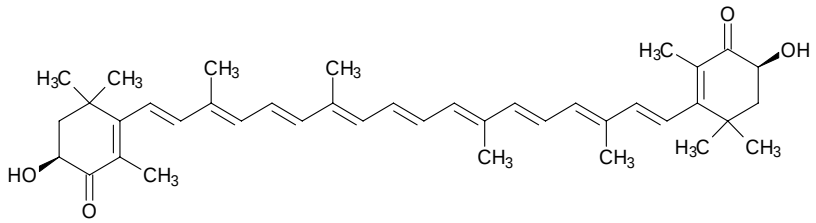
a) PUFA 44.4–46.0%
total n-3 PUFA 39.7–41.1% (mainly EPA/DHA)
total n-6 PUFA 4.5–5.1%

b) Saturated: palmitic (16:0) ~20%

c) 18 different sterols: ~ 30% thereof is cholesterol

Astaxanthin in EPA/DHA enriched single cell oil

$scCO_2$ based process of dried algae bio mass (*haematococcus pluvialis*)



Typical results

- Yield: ~30% fatty oleoresin
- Total pigment content: 4–11% (= 83–95% efficacy) depending on process settings

Composition of pigments:

- Mainly astaxanthin (>90 esterified with PUFA)
- Up to 40% EPA /DHA

Traces of others pigments: lutein, carotinoids

Application: feed, food fortification, coloring, pharma, cosmetic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